1. OVERVIEW

Subject Area	Fundamentals of Biochemical Engineering
Degree	Bachelor's Degree in Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	2º
ECTS	9
Type	Compulsory
Language(s)	English
Delivery Mode	On campus
Semester	S1-S2
Academic Year	25-26
Coordinating professor	Carla Jiménez Jiménez
Teacher	Ana Sánchez Arroyo

2. INTRODUCTION

The Fundamentals of Biochemical Engineering is a compulsory subject worth 9 ECTS and is taught yearly in the second year of the Bachelor's Degree in Biotechnology and the Combined Degree in Pharmaceuticals and Biotechnology. This subject belongs to the INSTRUMENTAL METHODS AND BIOCHEMICAL ENGINEERING module worth a total of 30 ECTS.

The aim of this subject area is to provide students with knowledge of biochemical engineering to understand its different industrial applications in processes based on biological catalysts. This subject area will provide a base for understanding and learning other subjects and developing a professional career.

3. LEARNING OUTCOMES (RA, by the acronym in Spanish)

Knowledge (CON, by the acronym in Spanish)

CON04. Identify the techniques and basic methodology for analysing proteins of biotechnological interest. Understand the mechanisms and kinetics of enzymatic reactions and be able to establish their regulation mechanisms.

Abilities (HAB, by the acronym in Spanish)

HAB04. Design experimental procedures and protocols choosing the most suitable technique in the field of biotechnological research, all the while meeting quality and legislative standards.
Applied biotechnological processes, kinetics and biocatalyst control and understand the basic functioning of bioreactors.

Skills

COMP06. Develop the skills needed to use the most common equipment, instruments and basic techniques in biotechnology, following quality standards and current biosecurity regulations.

COMP08. Design and execute operation protocols for bioreactors and purification of biotechnological products.

COMP16. Identify and use the tools and applications of metabolic engineering.

4. CONTENTS

- Introduction to biochemical engineering.
· Phenomena and transport mechanisms in biochemical engineering.
· Velocity transport equations and properties of transport.
· Material and energy balances.
· Enzymatic kinetics and cell cultures.
· Confined and immobilised biocatalysts (cells and enzymes): characteristics and applications.
· Introduction to designing bioreactors.
· Introduction to separation sequences.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture
- Collaborative learning
- Project-based learning
- Learning based on workshop teaching

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	56
Asynchronous master lectures	14
Case Studies	2
Problem-solving	27
Spoken presentations	4
Written reports and essays	10
Tutorials	20
Independent working	63
Workshops and/or lab work	13

Research (scientific/case studies) and projects	8
On-campus knowledge tests	8
TOTAL	**225**

7. ASSESSMENT

The assessment methods, together with how much they each count towards the final grade for the subject area, are as follows:

On campus:

Assessment system	Weight
On-campus knowledge tests	60
Spoken presentations	5
Reports and written work	15
Case study/problem scenario	10
Laboratory practice	10

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period you must obtain a mark of 5.0 or more out of 10.0 in all assessed parts of the subject. Any part you do not pass in the ordinary exam period will need to be recovered in the extraordinary exam period (resits).

Your final grade will be the average of the partial marks in each of the learning activities you have passed. The continuous assessment system for the learning activities requires attendance to at least 50% of the classes.

It is compulsory for students to accredit attendance to at least 50% of classes. This requirement is essential to the assessment process and qualifies students for the right to obtain academic counselling, support and monitoring from the professor. To this end, students must use the technological means made available by the University to accredit their daily attendance to each of their classes. This system will also serve to guarantee an objective record of the active role of the students in the classroom. Failure to accredit attendance to at least 50% of the classes by any of the means proposed by the University will mean that the professor awarding a fail to the student for that subject area in the ordinary exam period in accordance

with the grading system outlined in these regulations. All of the above, without prejudice to the other requirements or higher attendance percentages that other faculties may stipulate in their learning guides or internal regulations. Regulations for the assessment of official degree programmes, Art. 1 point 4. (http://www.uem.es/myfiles/pageposts/reglamento_evaluacion_titulaciones_oficiales_grado.pdf).

7.2. Extraordinary exam period (resits)

To pass the subject area in the extraordinary exam period (resits), the students must obtain a mark equal to or above 5.0 out of 10.0 in all parts of the subject assessment they did not pass during the ordinary exam period.

The student must submit the activities not passed in the ordinary exam period taking into account the corrections or comments made by the teacher. The student must also submit any activities which were not submitted.

The final grade will be the average of the partial marks in each of the activities passed (with a mark equal to or higher than 5 out of 10). The marks for the assessable activities the student passed in the ordinary exam period will be maintained for calculating this grade.

8. TIMELINE

The timeline with delivery dates of assessable activities in the subject area is indicated in this section:

Assessable activities	Date
Knowledge tests	Week 15 (S1 and S2)
Solving problems, application exercises and numerical problems	Throughout the whole course
Laboratory work	Weeks 1-3 S2 (depending on group)
Project-based learning (PBL)	Week 6 (S2)
Idea-based learning (IBL)	During S2

The timeline may be subject to modifications for logistical reasons of the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The reference work for following this subject area is:

- Doran, P.M., “Principios de ingeniería de los bioprocesos”, Academic Press, Londres, 1995
- Diaz, M. “Ingeniería de Bioprocesos”, Ed. Paraninfo, 2021

The recommended bibliography is indicated below:

- Bailey, J.E. y Ollis, D.F., “Biochemical Engineering Fundamentals”, McGraw Hill, New York, 1986.
- Belter, P. A. Downstream processing for biotechnology, Wiley, 1988.
- Dubasi Govardhana Rao, Introduction to Biochemical Engineering, Sec Edition. Tata MacGraw Hill, 2010.
- Ghasem Najafpour. “Biochemical Engineering and Biotechnology”, Sec Edition. Elservier, 2015
- Harrison, R. G. Bioseparations science and engineering, OUP USA. 2015.Belter
- Lehninger, “Principios de bioquímica”. 6ª edición. MacMillan, 2014
- Marcilla Gomis. ”Introducción a las operaciones de separación” Espagrafic, 1998.
- Rajiv Dutta ”Fundamentals of Biochemical Engineering” Springer Berlin Heidelberg 2008

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

The Educational Guidance and Diversity Unit (ODI in Spanish) offers support throughout your time at university to help you with your academic achievement. Other cornerstones of our educational policy are the inclusion of students with special educational needs, universal access in all our university campuses and equal opportunities.

This ODI unit offers students:

1. Support and monitoring through counselling and personalised student plans for those who need to improve their academic performance.
2. Curricular adaptations to uphold diversity, with assistance for those students who require specific educational support, leading to equal opportunities without significant changes to methodology or evaluation.
3. We offer students a range of extracurricular educational resources to reinforce skills which will enhance their personal and professional development.
4. Career guidance by offering tools and advice to students with doubts regarding their professional careers or those who believe they have chosen the wrong line of study.

Students who need educational support can contact us at:
orientacioneducativa@universidadeuropea.es

11. SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degree courses and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the course.

Many thanks for taking part.